POINTFUL EDUCATION

Fundamentals of Blockchain & Cryptography

Syllabus

» Course Overview

Blockchain seems to be the latest buzzword that the business world is taking about. But what is it? And why should a high school student care? This course will seek to answer those questions. It will strip away the layers of complexity and sophistication to help students understand the key concepts of the blockchain. The course will introduce and discuss applications where blockchain has the greatest potential.

» Course Outline by Module

Module 1	Intro to Blockchain and The Blockchain	**Module 5**	Blockchain and Smart Contracts
Module 2	Blockchain and Transactions	**Module 6**	Blockchain and Music
Module 3	Blockchain and Education	**Module 7**	Blockchain and Voting
Module 4	Blockchain and Identity	**Module 8**	Blockchain and Healthcare

» Module Overview and Learning Objectives

Module 1. Intro to Blockchain and The Blockchain

You don't need to understand HTML to send an email. You don't need to understand how a microprocessor works to play a video game. You don't need to understand air chemistry in order to breathe. And you don't need to understand advanced cryptography and game theory to grasp potential of blockchain and its endless applications! This module will introduce students to the most basic concepts of what a blockchain is and how it works. The principles and vocabulary in this module will lay the foundation for subsequent modules as students dive into relevant and exciting blockchain applications.

***Learning Objectives*:** In this module, students will:

- Describe bitcoin, its creation, and how it functions
- Define blockchain and distributed ledger technology
- Differentiate between a private and public blockchain, and permission and non-permissioned blockchains
- Evaluate the principle of trust in society and how blockchain technology enables greater trust
- List possible applications of blockchain technology

Module 2. Blockchain and Transactions

Intermediaries have had an important role throughout economic history. They have created markets and assumed risk. But today, it seems like intermediaries (also referred to as "middlemen"), siphon off high transaction fees, are slow and inefficient, and fail to protect privacy and information. The elegant technology behind bitcoin and blockchain can reduce the power of intermediaries by decentralizing control. This module explores how blockchain, or distributed ledger technology, can allow us to exchange value electronically. Students will explore how this has the potential to reshape society.

***Learning Objectives*:** In this module, students will:

- Describe how ledgers record transactions and examine how double-entry book-keeping paved the way for capitalism
- Differentiate between centralized and decentralized ledgers
- Define and give examples of intermediaries in today's economy
- Explain transaction costs for both buyers and sellers
- Describe how blockchain-based transactions can improve trust and reduce costs
- Identify career opportunities in blockchain technology at banks and educational paths to enter those careers

Module 3. Blockchain and Education

Does blockchain technology have a place in education? Absolutely! Despite advances in technology, high school diplomas are still printed on paper (along with a fancy stamp and signature). However, our antiquated systems have allowed fake and forged diplomas to run rampant both in the US. and internationally. However, there are features of blockchain technology that can help fix this problem. Several companies are working with schools all across the world to reduce diploma fraud and give students control of their educational records and credentials. In this module, students will learn the many ways that blockchain technology might become a part of their education in the future.

***Learning Objectives*:** In this module, students will:

- Evaluate the size and scope of the problem of fraudulent and fake degrees
- Compare a blockchain-based credential with a traditional paper-based credential
- Describe companies and projects that are utilizing blockchain-based credentials
- Discuss the benefits and risks of using the blockchain for education credentials
- Examine additional ways that blockchain technology can be used in education beyond credentials

Module 4. Blockchain and Identity

High school students today are growing up in a world where identity management is a mess. Many companies and government agencies control various pieces of our identity. Problems are compounded by hacks and data breaches that expose private and sensitive data. And millions throughout the world, such as refugees or people in poverty, lack access to basic identity documents. In this realm, blockchain holds tremendous potential to allow people to control and protect their own data. This module will highlight some of the most promising projects and companies that are developing solutions for blockchain-based identity solutions.

***Learning Objectives*:** In this module, students will:

- Describe the problems of current identity management
- List the limitations of biometric identification, paper-based documentation, and physical signatures
- Differentiate between physical and digital identity
- Define self-sovereign identity
- Evaluate projects and companies that are creating blockchain-based solutions that help solve global identity problems
- Discuss the growing field of blockchain jobs and careers in identity management

Module 5. Blockchain and Smart Contracts

Experts believe that blockchain will disrupt, or radically change, many things from the way they have been done in the past. And contracts are no different. Contracts have been used for millennia as a way to replace trust. Today an entire system of lawyers, courts, and legislation has been built to govern contracts. They determine how contracts work and what to do when they are broken. This module explores how blockchain technology could change society's approach to contracts. Students will learn about the Ethereum blockchain and how it enables smart contracts, or contracts based completely and solely on computer code. The module also examines problems and risks with such a system.

***Learning Objectives*:** In this module, students will:

- List the components of a contract and summarize why contracts are used
- Provide examples of traditional contracts
- Describe the problems with traditional contracts, contract law, and enforcement/execution
- Define smart contract
- Evaluate how blockchain technology, including the Ethereum blockchain, can be used to create and execute smart contracts
- List examples of smart contract projects and applications
- Examine the problems and risks with smart contracts (compared to traditional contracts)

Module 6. Blockchain and Music

Did you know that when someone streams a song on a service like Spotify, the rights holder to that song only receives barely more than half a cent per song? And that's to the rights holder of the music; there are labels and publishers that take their cut, with a small fraction actually going to the musicians. However, new blockchain-based systems are emerging that give more control and security to musicians, artists, and photographers over their creations. This module will explore an artist-centric model through blockchain technology and it may transform the way music is listened to in the future.

***Learning Objectives*:** In this module, students will:

- Define the problems with the existing music and record label industry
- Describe how blockchain technology can be used in the music industry
- Outline the benefits for musicians, artists, and fans by using blockchain based systems
- Compare some existing blockchain music project and companies
- Discuss the downsides or problems of using the blockchain for music rather than existing systems

Module 7. Blockchain and Voting

A central tenet of democracy is the power of the vote. Citizens want to make sure their voice is heard through their power to vote. Traditional paper-based systems have been the norm for centuries now, but can be susceptible to fraud, corruption, and mistakes, both in the U.S. and other countries. However, electronic or internet-based voting can also be at risk to hackers or system malfunctions. Does blockchain have a solution here? Many people think it has the potential to eliminate voter fraud and prevent any chance of a rigged election. This module will explore the concept of blockchain-based voting systems and its applications across nationwide votes, legislatures, and even corporations. Students will also discuss and explore some of the possible risks to this new approach to voting.

***Learning Objectives*:** In this module, students will:

- Define the problems with the existing paper and electronic voting systems
- Describe how blockchain technology can be used in securing digital voting records
- Outline the potential benefits of blockchain technology when applied to elections and voting
- Discuss the downsides or problems of using the blockchain for voting rather than existing systems
- Compare and explain blockchain voting projects and companies

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Module 8. Blockchain and Healthcare

Personal healthcare records contain intimate and private details of our lives! Some are trivial, while others can be embarrassing or serious. With that in mind, who is keeping healthcare records secure? Is it a surprise then that healthcare experiences the most cyber-attacks out of any industry? Again, in this realm blockchain's security and structure may provide solutions to problems that healthcare organizations have been struggling with. This module will explore how blockchain can improve both data security and access to records by patients and medical professionals.

***Learning Objectives*:** In this module, students will:

- Outline the problems with medical records, including data breaches, privacy, and data management
- Describe how blockchain technology can be used in controlling, securing, and monetizing personal healthcare records
- Define the healthcare supply chain for medicine and identify problems with the supply chain
- Evaluate the potential for blockchain to improve the healthcare supply chain
- Identify career opportunities in healthcare and blockchain technology and educational paths to enter those careers